Anirudh Singhal | **16D070032**
Electrical Engineering | **UG Third Year (Dual Degree)**
Indian Institute of Technology Bombay | **Male**
Specialization: Communication and Signal Processing | **DOB: 18.05.1998**

Examination	University	Institute	Year	CPI / %
Graduation	IIT Bombay	IIT Bombay	2019	9.25
Intermediate/+2	CBSE	The Khaitan School	2016	94.60
Matriculation	CBSE	Khaitan Public School	2014	10.00

Pursuing a **Minor Degree** in **Computer Science and Engineering** Department with minor degree CPI of **9.67**

Scholastic Achievements

- Attained **perfect 10** SPI during the **semester exchange** in **Technical University of Denmark** *2019*
- Awarded **AP Grade** for outstanding performance in the course on **Network Theory** and **Markov Chains and Queuing Systems** *2019*
- Secured **All India Rank 368** out of 1.5 lakh candidates in **JEE Advanced** *2016*
- Recipient of prestigious **Kishore Vaigyanik Protsahan Yojana**(KVPY) Scholarship *2015*
- Awarded certificate of merit for statewise **top 1%** in **National Standard Examination in Physics** *2015*
- Qualified for **Indian National Chemistry Olympiad** (INChO) based on performance in NSEC *2015*

Internships

Adobe Systems, India *May'19-Jul'19*

Research Intern, Media and Data Science Research Lab, Adobe

Visual compatibility prediction refers to the task of determining if a set of clothing items go well together. Existing techniques for compatibility prediction prioritize sensitivity to type or context in item representations and evaluate using a fill-in-the-blank (FITB) task.

- Scaled the FITB task by increasing the number of options to **stress-test** existing methods which highlights their degradation of performance by increasing the number of options and the need for a unified compatibility framework
- Introduced a unified framework for compatibility learning that consists of the following components
  - **TC-GAE** : A type conditioned **Graph Convolutional Network** (GCN) that models type and context of an item
  - **SAE** : An attention based **Style Autoencoder** that extracts style of an outfit by projecting it on a style basis
  - A **RL** based search technique that incorporates these modalities to learn a unified compatibility measure
- The new model significantly **outperforms** the existing **state-of-the-art** models on the two standard datasets

This project has resulted in a **paper** accepted in **WACV 2020** and a **patent** filed through the **United States Patent and Trademark Office** (USPTO) in May 2020

OkCredit, Bangalore *May'18-Jul'18*

OkCredit is a mobile based digital ledger for small businesses in India that extend credit to their customers

- Designed infrastructure to collect user interactions from the mobile app for targeted communication with them
  - Built a server in **Google Go** to store data in a **Cassandra** database and transfer it to **Amazon S3** daily
  - Created an **Android Library** to store the user data locally and send it to the server
- Developed user authentication service in Google Go based on **Oauth 2.0** for mobile and web applications
- Devised and performed **unit**, **load tests** of REST APIs to calculate their maximum load as function of resources

Research Experience

Adaptive Mode Estimation of a Continuous Distribution *Jan'20-Present*

Guide : Prof. Nikhil Karamchandani, Electrical Engineering, IIT Bombay

Estimating the most likely outcome of a probability distribution is a useful primitive in many computing applications such as counting, natural language processing, clustering, etc. We develop a novel method to find the mode of a dataset with an continuous underlying distribution, by adaptively finding the point with nearest kth neighbour. Instead of using all the dimensions we randomly sample a dimension to get an unbiased estimate of the distance.

- Implemented **Action Elimination** Algorithm to find the best arm in **Multi Armed Bandit** Problem to find the point with nearest kth neighbour(estimated mode), by modelling distance across each dimension as an arm
- Achieved a **90% reduction** in the number of queries required to find the point with nearest kth neighbour
- Conducted experiments to show that the point with the kth nearest neighbour is the mode of a dataset

Interpolation of MIMO-OFDM Kerdock Precoders *Jan'20-Present*

Guide : Prof. Kumar Appaiah, Electrical Engineering, IIT Bombay

Precoding transmissions in wireless MIMO systems is essential to enable optimal utilization of the spatial degrees of freedom. However, communicating the precoding matrices from the receiver is challenging, owing to large feedback requirements. In order to reduce the amount of feedback we find precoders with quaternary alphabets(Kerdock Codes) for only the pilot sub-carriers in OFDM and use interpolation techniques to find precoders for other sub-carriers.

- Used **Kerdock Codes** to find the precoders for the pilot sub-carriers in MIMO-OFDM
- Implemented **Geodesic Interpolation** to find the MIMO-OFDM precoders in between the pilot sub-carriers

Key Projects

Digitally Programmable Analog Computer *Jan'19-May'19*

Guide: Prof. Mukul Chandorkar, Electrical Engineering, IIT Bombay

- Implemented a hybrid system to solve **non-linear differential equations** in up to **eight state variables**
- Designed an **analog module** using integrator blocks for fast computations over a wide frequency range
- Interfaced it with a **digital module** consisting of a fast microcontroller to compute non-linear expressions
- Implemented on a stand-alone **two-layer printed circuit board** (PCB) with on-board power management

Texture Synthesis by Non-parametric Sampling *Nov'18*

Guide: Prof. Ajit Rajwade & Suyash Awate, Computer Science Engineering

- Synthesized a texture from an initial seed on MATLAB which was used for **hole filling** and **image expansion**
- Modelled the image as a **Markov Random Field** (MRF) to find probability distribution of a pixel to be predicted

Classification of Various Datasets using Neural Networks *Nov'18*

Guide: Prof. Sunita Sarawagu, Computer Science Engineering

- Developed feed-forward neural networks for classifying text, image and speech data using **TensorFlow**
- Worked with various regularizers and activation functions on a **four-layer** topology to attain 98.0 percent accuracy on MNIST, 94 percent on stop-go speech and 80.4 percent accuracy on Census Income Adult Classification datasets

Lazy Lock: Automatic Lock *May'17-Jan'17*

Institute Technical Summer Project *Institute Technical Council*

- Designed and implemented an automated door unlocking mechanism which unlocks by **gesture detection**, **knock pattern** and remotely from an **android app** along with a Do not Disturb (DND) option
- Implemented **Image Processing** algorithms using **OpenCV** on **RaspberryPi** (RPi) for gesture recognition
- Improved gesture recognition accuracy by employing **Machine Learning** using **scikit-learn** in python
- Integrated RPi with **knock detector circuit** such that it unlocks only on a unique knock pattern

Electrical Subsystem, Advitiy *Feb'17-March'19*

Advitiy is the 2nd student satellite of IITB, technically advanced and efficient version of the 1st, Pratham

- Critically analyzed various parameters and constraints to **finalize the microcontroller** of On Board Computer
- Proposed the use of **Real Time Operating System** (RTOS) to carry out the scheduling of tasks being run on the On Board Computer and conceptualized a **scheduling algorithm** for the same
- Performed **functionality test** on flight hardware of Pratham to get familiar with source code and its peripherals
- Interfaced **Magnetometer** with On Board Computer using **UART** Communication Protocol

Encrypted Audio Transmission using Chaotic Circuits *Apr'18*

Guide: Prof. Siddharth Tallur, Electrical Engineering

- Designed and implemented a third order **chaotic oscillator** for encryption and decryption of audio signals
- Encrypted audio signal using **white noise** created by the chaotic transmitting oscillator

Technologies for Soldier Support *Dec'17-Jan'18*

Part of an 8 member team that represented IIT Bombay in the Inter IIT Technical Meet held at IIT Madras

- Fabricated a smart glove using **flex sensors** and **accelerometer** to detect soldier's hand gestures
- Built a headband which could monitor Soldier's important physiological parameters such as Heartbeat, Temperature and Head Impact Force using **optical pulse sensor, temperature sensor** and **accelerometer**

Multi-Client Server using Forking *Aug'17*

Guide: Prof. Mythili Vutukuru, Computer Science Engineering

- Programmed a **TCP server** in C++ which connects to various clients simultaneously
- Created a map which takes key-value pairs from clients and stores it, while also serving to any client

Positions of Responsibility

Subsystem Leader, Electrical Subsystem, Advitiy *Feb'18-March'19*

Advitiy is the 2nd student satellite of IITB, technically advanced and efficient version of the 1st, Pratham

- Spearheaded a **10 membered** inter-disciplinary team of two subdivisions, Power and On-Board Computer to design the power distribution circuit, interface with peripherals and implement the control algorithm
- Ensured implementation of **Quality Assurance Practices** to guarantee **100%** reliability
- Recruited **9 candidates** from over **100 applicants** by conducting a three stage selection procedure which tested technical skills, practical approach and teamwork
- Contributed to **Satellite 101 wiki**, a compilation of exhaustive knowledge of satellite project which reached **5.8k** page views and **1.4k** users around the globe within a month

Teaching Assistant, Differential Equations *Jan'19-April'19*

Prof. Swapneel Mahajan, Department of Mathematics, IIT Bombay

- Responsible for grading tests and conducting weekly tutorials for a class consisting of 50+ students

Technical Skills

Languages	Google Go, SQL, VHDL, C, C++, Python, Embedded C, Java
Micro-controller Programming	Atmel Studio, ArduinoIDE, RPi
Simulation and CAD Softwares	Proteas, NGSpice, SolidWorks, AutoCAD
Other Softwares and Modules	Android Studio, TensorFlow, OpenCV, Scikit-Learn, Git, Quartus

Key Courses Undertaken

Electrical Engineering	Acoustic Signal Processing, Wireless Communications, Network Security, Signals and Systems, Analog and Digital Systems, Communication Systems, Microprocessors
Computer Science	Advanced Machine Learning, Digital Image Processing, Introduction to Machine Learning, Operating Systems, Computer Networks, Data Structures and Algorithms
Mathematics and Statistics	Data Analysis and Interpretation, Probability and Random Processes, Markov Chains and Queuing Systems

Extra Curricular Activities

- **Social Work**
  - Volunteered in **NGO Vidya** for tutoring financially and socially underprivileged children
  - Taught English to college kitchen staff as a part of **Adult Literacy Program (ALP)**, NSS
  - Devoted **80+ Hours** to Social Service under **National Service Scheme, IIT Bombay**
  - Helped in **organizing CURED**: a diabetes awareness campaign attempting **Guinness World Record** for maximum number of glucose level check-ups covering **200+ camps in 10 states**
- Successfully completed **Mountaineering Adventure Course (MAC)** which is affiliated to Government of India and Government of Jammu and Kashmir
- Successfully completed **Swimming Camp** conducted by sports council as a part of Summer of Sports
- Presented **Pratham, IIT Bombay Student Satellite** in a national exhibition before an audience of over 400